

(10) **Patent No.:** US 9,242,424 B2  
(45) **Date of Patent:** Jan. 26, 2016

2307/7246 (2013.01); B32B 2457/20 (2013.01);  
G02F 1/133345 (2013.01); H01L 27/3244  
(2013.01); Y10T 428/239 (2015.01)

(58) **Field of Classification Search**  
CPC ..... H05B 33/04; B32B 3/04; B32B 27/06;  
B32B 2457/20; B32B 2457/206; B32B  
2457/202; H01L 51/5246; H01L 27/3244;  
Y10T 428/239

USPC ..... 428/76; 313/512; 257/100  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,432,516	B1 *	8/2002	Terasaki et al. ....	428/195.1
2010/0171147	A1 *	7/2010	Hayashi et al. ....	257/100
2011/0175523	A1 *	7/2011	Kostka et al. ....	313/512
2011/0233557	A1 *	9/2011	Yamazaki et al. ....	257/71
2012/0062111	A1 *	3/2012	Goto ..... H01L	51/5253
				313/512

FOREIGN PATENT DOCUMENTS

JP 2009-301816 A 12/2009

\* cited by examiner

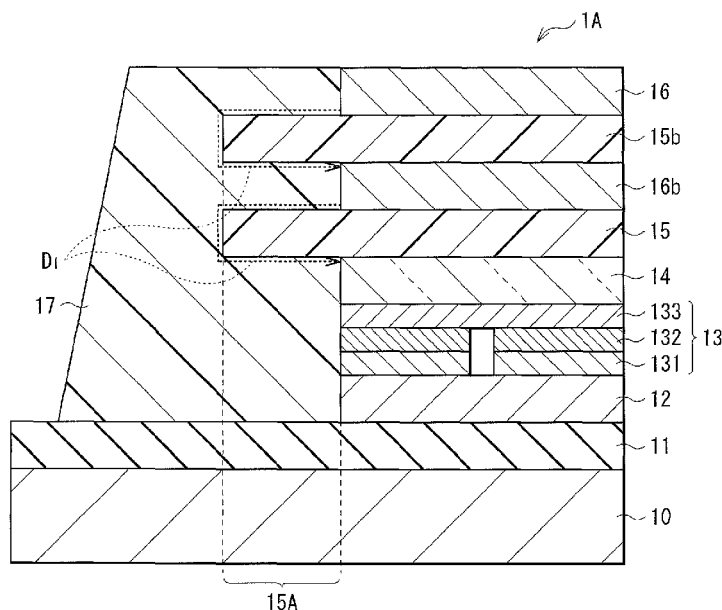
Primary Examiner — Aaron Austin  
Assistant Examiner — Jasper Saberi  
(74) Attorney, Agent, or Firm — Sheridan Ross P.C.

(57) **ABSTRACT**

A display device includes: a display layer; a surface film disposed to face a display surface of the display layer; and a moisture-proof film disposed between the display layer and the surface film and including a projecting section. The projecting section projects outwardly of an end face of the display layer and an end face of the surface film.

(52) **U.S. Cl.**  
CPC . *B32B 3/04* (2013.01); *B32B 27/00* (2013.01);  
*H01L 51/5246* (2013.01); *H05B 33/04*  
(2013.01); *B32B 2307/40* (2013.01); *B32B*

**16 Claims, 11 Drawing Sheets**



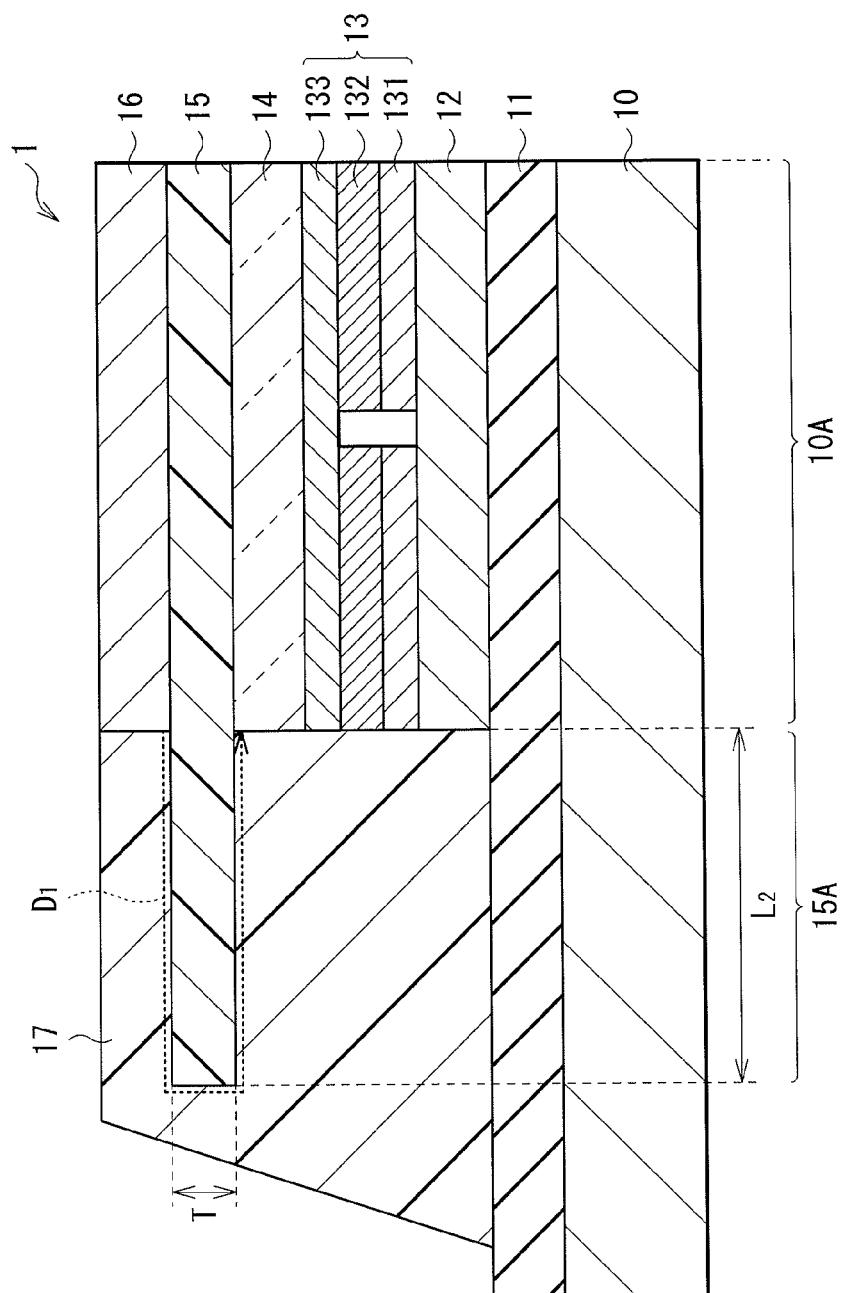


FIG. 1

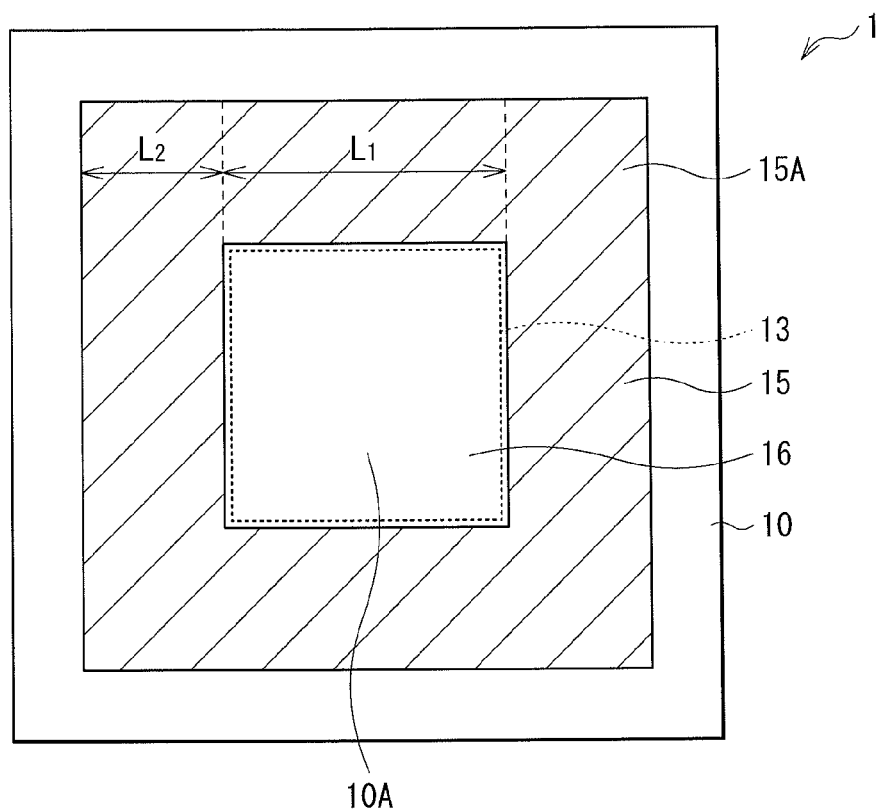


FIG. 2

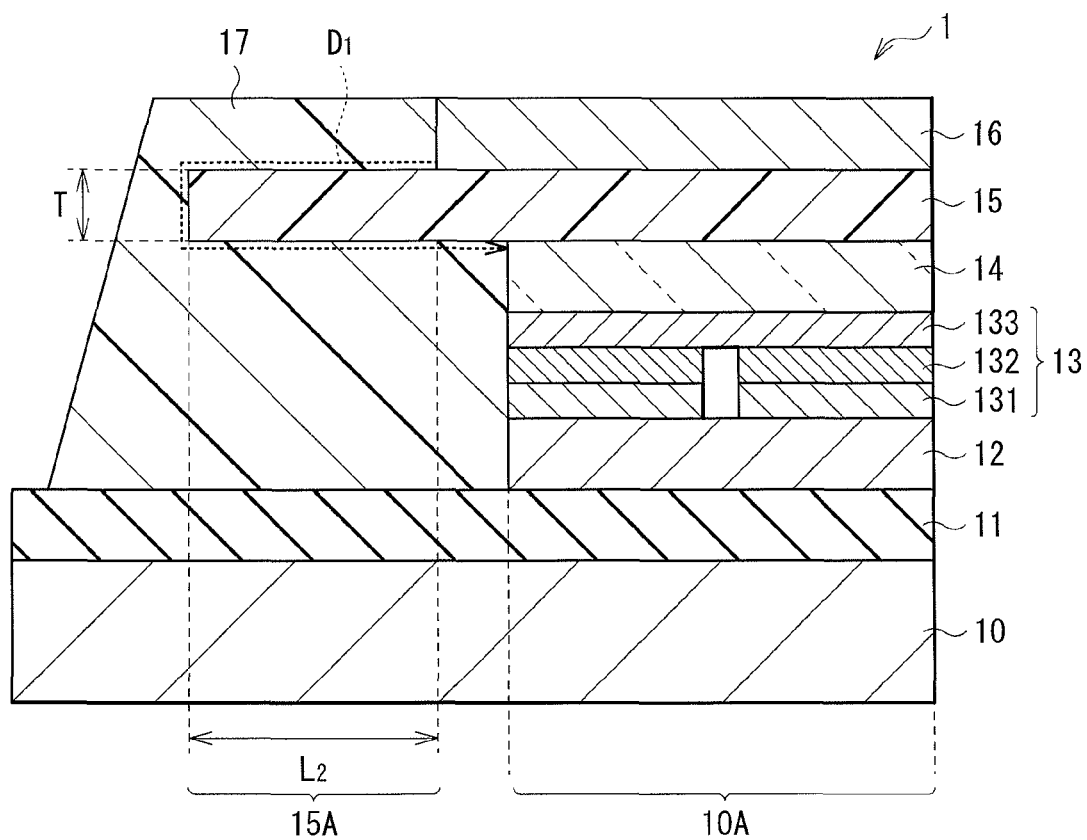
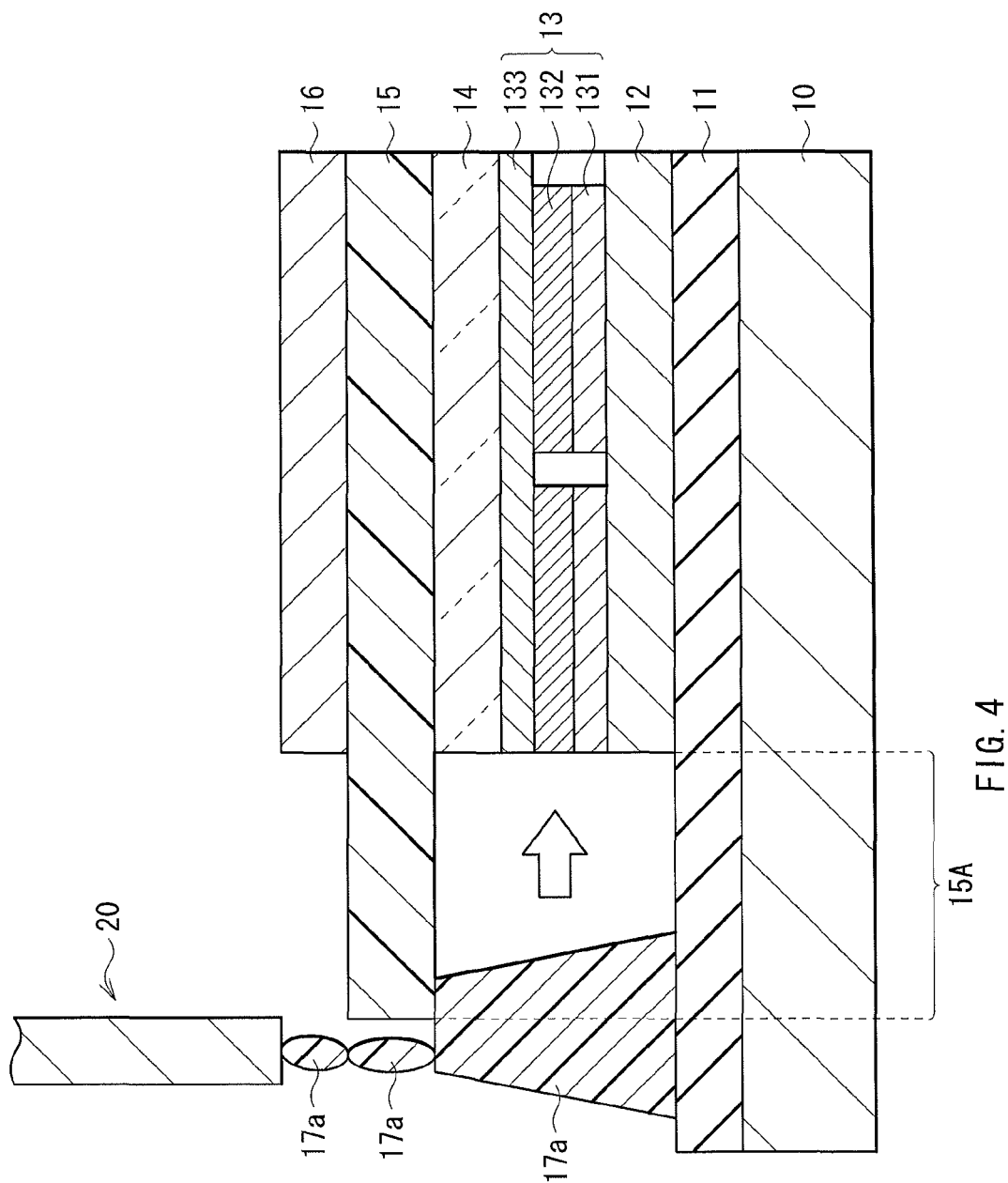


FIG. 3



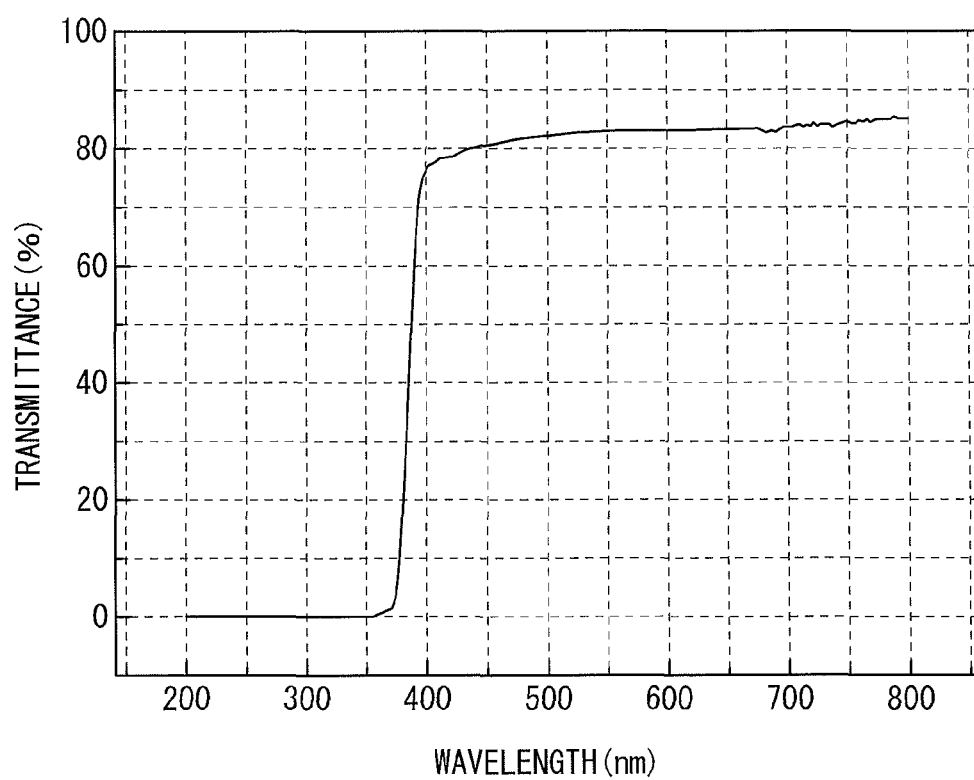


FIG. 5

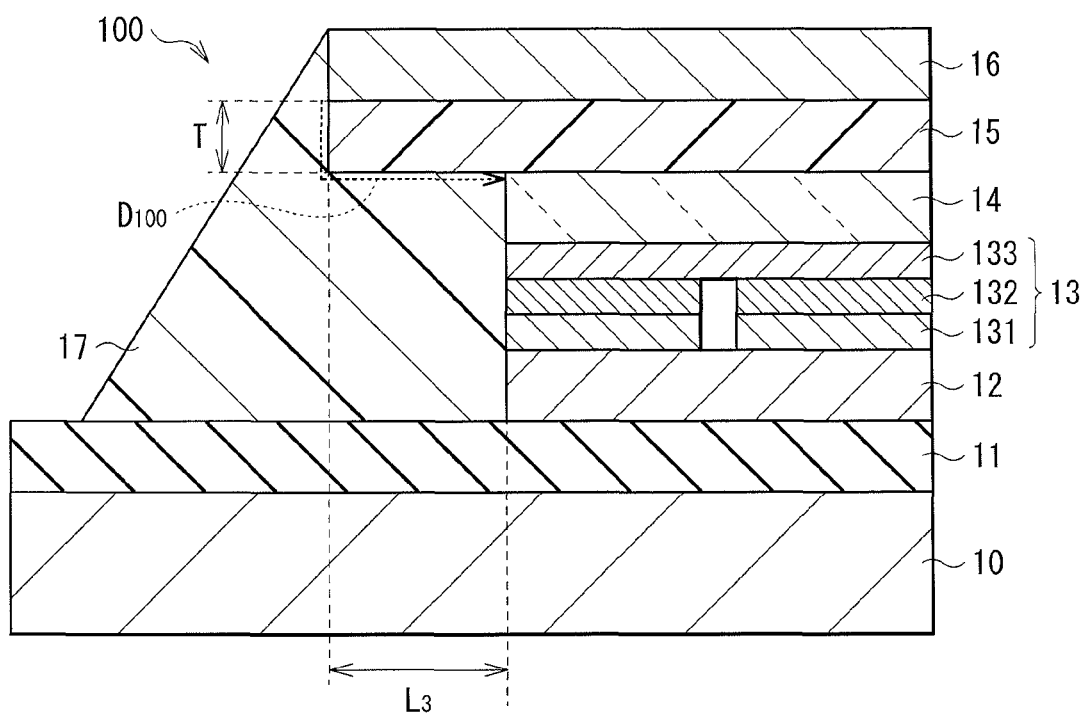


FIG. 6

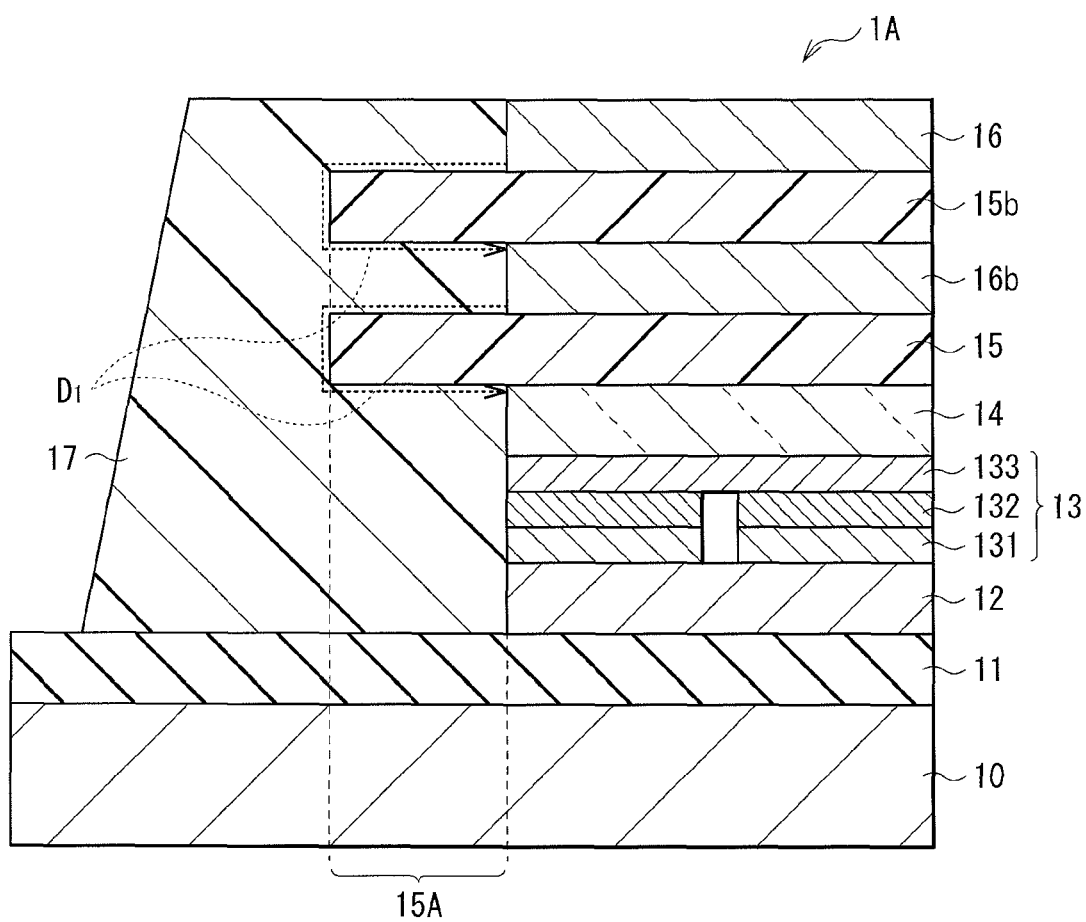


FIG. 7



FIG. 8A

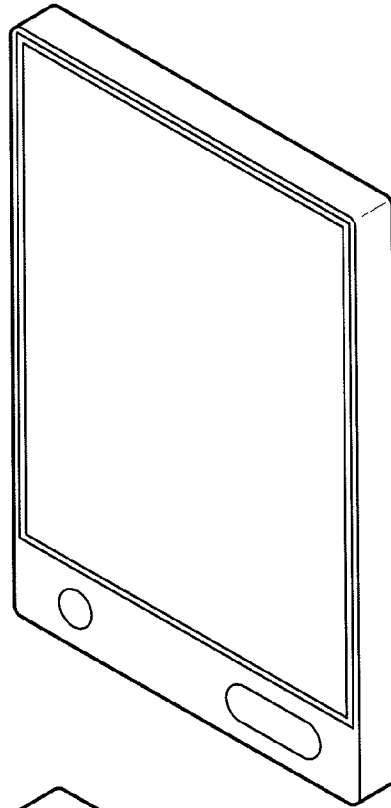
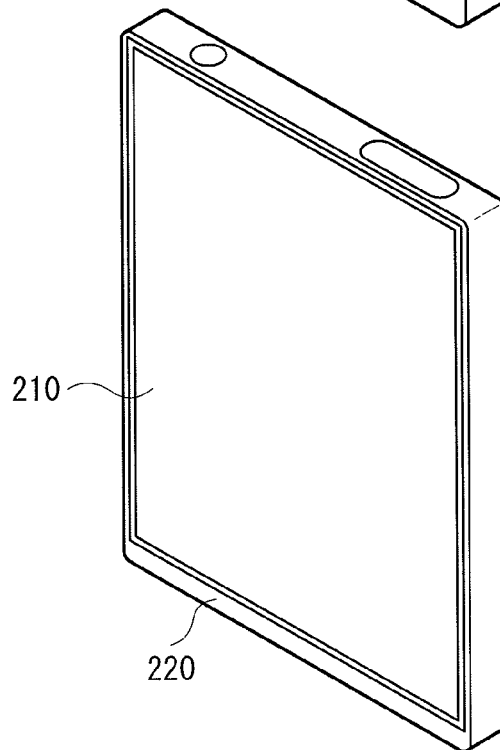


FIG. 8B



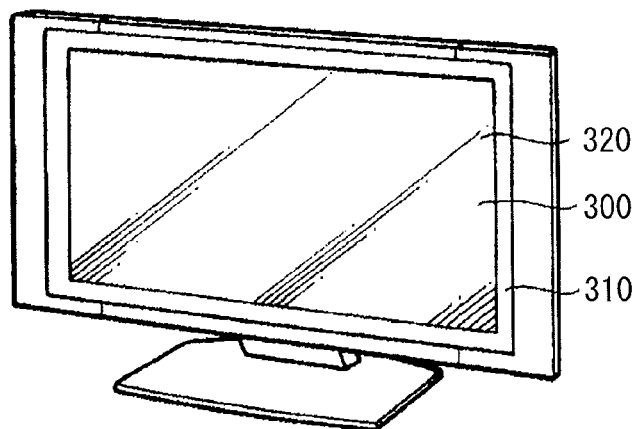


FIG. 9

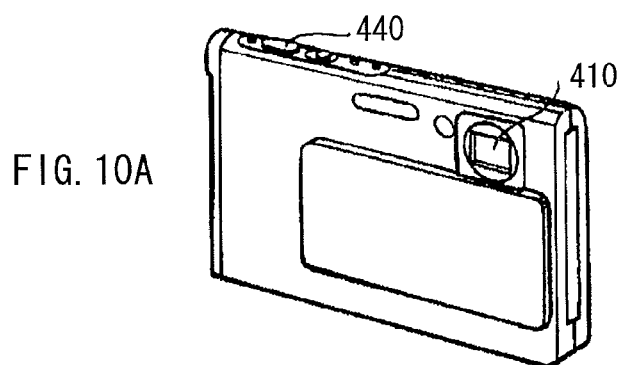


FIG. 10A

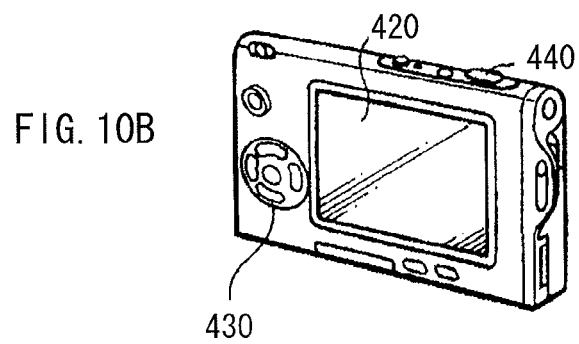


FIG. 10B

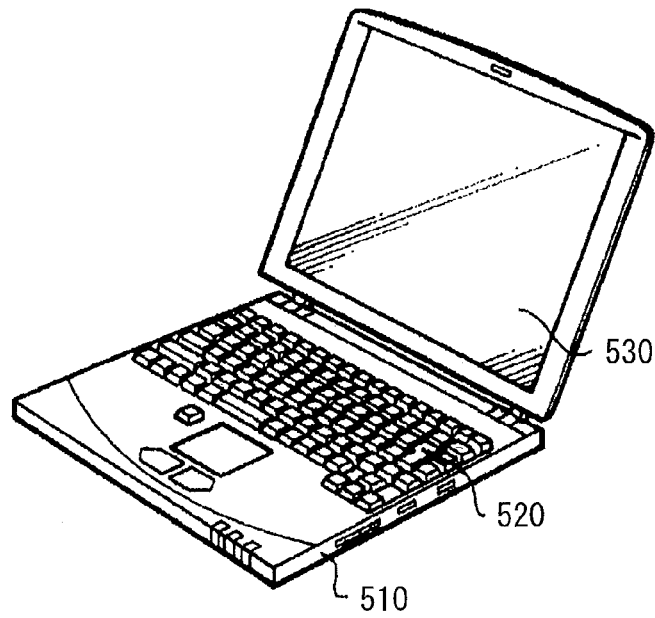


FIG. 11

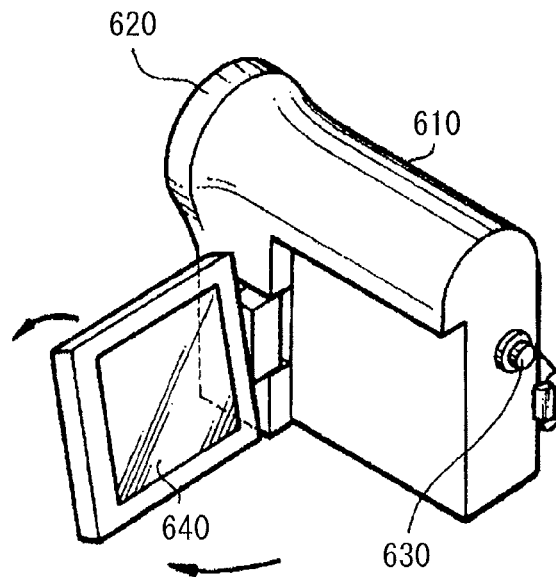


FIG. 12

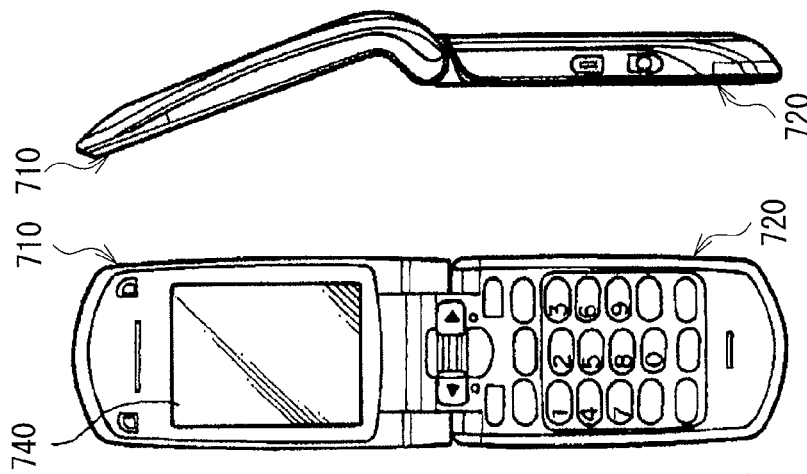


FIG. 13A

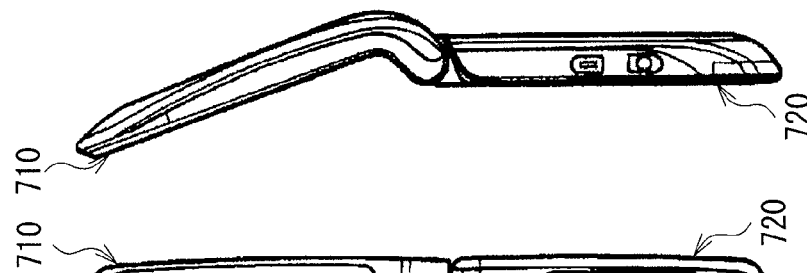


FIG. 13B

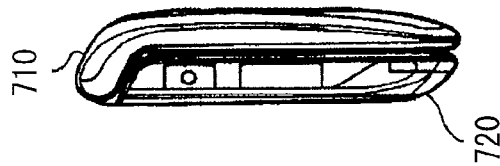


FIG. 13C

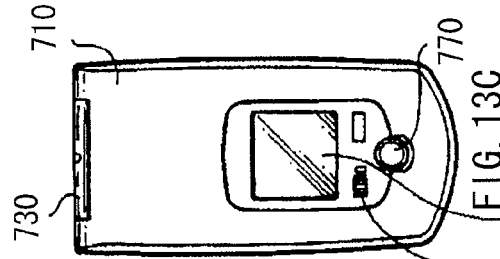


FIG. 13D

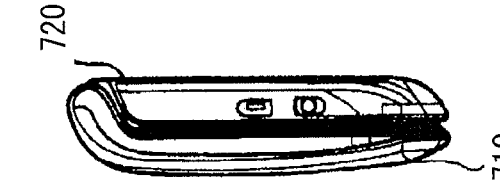


FIG. 13E

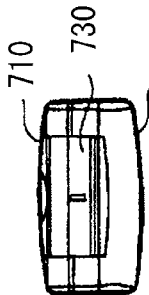


FIG. 13F

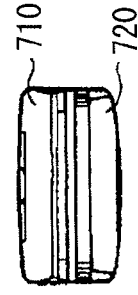


FIG. 13G

1

## DISPLAY DEVICE AND ELECTRONIC APPARATUS

### BACKGROUND

The present technology relates to a display device including a moisture-proof film for a display layer, and to an electronic apparatus including the display device.

Today, while liquid crystal display devices are widely used as flat display devices such as televisions, display devices such as organic EL (electroluminescence) display devices that achieve reduction in thickness and power consumption are drawing attention.

In such display devices that have been actively developed in recent years, a moisture-proof function is important because a display layer configured of an organic layer is easily degraded by moisture, for example. In view of this, a technique has been proposed in which a display layer is protected by a moisture-proof film having low moisture permeability for prevention of infiltration of moisture (for example, see Japanese Unexamined Patent Application Publication No. 2009-301816).

### SUMMARY

However, merely disposing a moisture-proof film on an upper portion of a display layer may not be enough to sufficiently produce the moisture-proof function for the display layer, and reliability may not be obtained. This also applies to other display devices such as liquid crystal display devices.

It is desirable to provide a display device having a high moisture-proof property and offering improved reliability, and to an electronic apparatus including the display device.

A display device according to an embodiment of the present technology includes: a display layer; a surface film disposed to face a display surface of the display layer; and a moisture-proof film disposed between the display layer and the surface film and including a projecting section. The projecting section projects outwardly of an end face of the display layer and an end face of the surface film.

An electronic apparatus according to an embodiment of the present technology is provided with a display device. The display device includes: a display layer; a surface film disposed to face a display surface of the display layer; and a moisture-proof film disposed between the display layer and the surface film and including a projecting section. The projecting section projects outwardly of an end face of the display layer and an end face of the surface film.

In the display device and the electronic apparatus according to the above-described respective embodiments of the present technology, the moisture-proof film is provided on the display layer, and the moisture-proof film is provided with the projecting section. Thus, an infiltration path of moisture from a side face into the display layer (distance along the surface) is lengthened by at least an amount corresponding to a top face of the projecting section.

According to the display device and the electronic apparatus of the above-described respective embodiments of the present technology, the moisture-proof film is provided between the display layer and the surface film, and the moisture-proof film is provided with the projecting section projecting outwardly of the display layer and the surface film. Thus, the infiltration path of moisture into the display layer is lengthened. Consequently, a moisture-proof function of the moisture-proof film for the display layer is enhanced, and the reliability is improved.

2

It is to be understood that both the foregoing general description and the following detailed description are exemplary, and are intended to provide further explanation of the technology as claimed.

### BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide a further understanding of the disclosure, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments and, together with the specification, serve to explain the principles of the technology.

FIG. 1 is a side sectional view showing a configuration of a display device according to an embodiment of the present technology.

FIG. 2 is a plan view showing the configuration of the display device illustrated in FIG. 1.

FIG. 3 is a side sectional view showing an exemplary arrangement of an optical functional film of the display device illustrated in FIG. 1.

FIG. 4 is a side sectional view showing a step of a method of manufacturing the display device illustrated in FIG. 1.

FIG. 5 is a diagram showing a relationship between wavelengths and transmittances of a film having an ultraviolet-ray blocking function.

FIG. 6 is a side sectional view showing a configuration of a display device according to a comparative example.

FIG. 7 is a side sectional view showing a configuration of a modification of the display device illustrated in FIG. 1.

FIGS. 8A and 8B are perspective views each showing an external appearance of an application example 1.

FIG. 9 is a perspective view showing an external appearance of an application example 2.

FIG. 10A is a perspective view showing an external appearance of an application example 3 as viewed from a front side, and FIG. 10B is a perspective view of an external appearance as viewed from a rear side.

FIG. 11 is a perspective view of an external appearance of an application example 4.

FIG. 12 is a perspective view of an external appearance of an application example 5.

FIG. 13A is a front view of an application example 6 in an unfolded state, FIG. 13B is a side view thereof, FIG. 13C is a front view of a folded state, FIG. 13D is a left side view, FIG. 13E is a right side view, FIG. 13F is a top view, and FIG. 13G is a bottom view.

### DETAILED DESCRIPTION

With reference to the drawings, an embodiment of the present technology will be described in detail below. It is to be noted that description will be made in the following order.

#### 1. Embodiment

A Display Device Including a Moisture-proof Film Provided with a Projecting Section

#### 2. Modification

A Display Device Including a Plurality of Moisture-proof Film

#### 3. Application Examples

#### Embodiment

#### Configuration of Display Device 1

FIG. 1 shows a cross-sectional configuration of a display device (display device 1) according to an embodiment of the present technology, and FIG. 2 shows a planar configuration

thereof. The display device **1** is, for example, an organic EL display device, and includes on a substrate **10** a barrier layer **11**, a TFT (thin film transistor) layer **12**, a display layer **13**, a transparent substrate **14**, a moisture-proof film **15**, and an optical functional film **16** in this order. A side face of a lamination section ranging from the TFT layer **12** to the optical functional film **16** is covered with a sealing section **17**. It is to be noted that FIG. 1 and FIG. 2 schematically show the structure of the display device **1**, and may differ from the actual dimension and form.

The substrate **10** is configured to support the display layer **13**, etc., and is made of, for example: an inorganic material such as glass, quartz, silicon, and gallium arsenide; a plastic material such as polyimides, polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polymethyl methacrylate (PMMA), polycarbonate (PC), polyether sulfone (PES), poly ethyl ether ketone (PEEK), and aromatic polyesters (liquid crystal polymers); or the like. The substrate **10** may be a substrate having stiffness such as a wafer, or may be a substrate having flexibility such as a thin-layer glass and a film. When the substrate **10** has flexibility, a bendable display device is realized. The substrate **10** includes a display region **10A**, and the TFT layer **12**, the display layer **13**, and the transparent substrate **14** are provided in a region corresponding to the display region **10A**.

The barrier layer **11** is provided between the substrate **10** and the TFT layer **12**. The barrier layer **11** is configured to prevent the display layer **13** from being degraded by factors such as moisture and organic gas, and is made of, for example,  $\text{AlO}_x\text{N}_{1-x}$  (where  $X=0.01$  to  $0.2$  both inclusive) or silicon nitride ( $\text{Si}_3\text{N}_4$ ).

The TFT layer **12** has a function as a switching element configured to select pixels. The TFT layer **12** may be configured of either an inorganic TFT using an inorganic semiconductor layer as a channel layer or an organic TFT using an organic semiconductor layer as a channel layer.

The display layer **13** includes a display body **132** between a pixel electrode **131** and a common electrode **133**. The pixel electrode **131** is in contact with the TFT layer **12**, and the common electrode **133** is in contact with the transparent substrate **14**. The pixel electrode **131** is provided for each pixel, and is made of one of metallic elements including chromium (Cr), gold (Au), platinum (Pt), nickel (Ni), copper (Cu), tungsten (W), and silver (Ag), or their alloys, for example. The display body **132** is configured of an organic layer including a light emitting layer, for example. The common electrode **133** is provided over the entire surface of the transparent substrate **14**, and is made of a light-transmissive conductive material (transparent electrode material) such as indium oxide-tin oxide (ITO), antimony oxide-tin oxide (ATO), fluorine doped tin oxide (FTO), and aluminum doped zinc oxide (AZO).

In the present embodiment, since an image is displayed on the transparent substrate **14** side, a light transmissive material is used to form the transparent substrate **14**. Except for this point, similar materials as those of the substrate **10** may be used for the transparent substrate **14**.

The moisture-proof film **15** is configured to prevent infiltration of moisture into the display layer **13**, and is disposed between the display layer **13** and the optical functional film **16**. The transparent substrate **14** and the moisture-proof film **15** are bonded together by, for example, a pressure-sensitive adhesive agent, a heat-sensitive adhesive agent, or the like. The moisture-proof film **15** is made of, for example, polyethylene terephthalate, polymethylmethacrylate, polycarbonate, polyethylene naphthalate, polypropylene, nylon-6, nylon-66, poly vinylidene chloride, polyether sulfone, or the like. It is

preferable that the moisture-proof film **15** have a moisture-proof property, specifically, a moisture permeability of  $0.1 \text{ g/m}^2/\text{day}$  to  $0.000001 \text{ g/m}^2/\text{day}$  both inclusive, preferably  $0.03 \text{ g/m}^2/\text{day}$  or lower for example, and at the same time, have a high light transmittance. The moisture-proof film **15** has a film thickness  $T$  (FIG. 1) of, for example,  $10 \mu\text{m}$  to  $100 \mu\text{m}$  both inclusive. The moisture-proof film **15** may have a lamination structure including a plurality of films.

In the present embodiment, the moisture-proof film **15** includes a region (projecting section **15A**) projecting outwardly of end faces of the display layer **13** and the optical functional film **16** described later. For example, when the length of a portion of the moisture-proof film **15** overlapping with the optical functional film **16** is a length  $L_1$ , and the length of the projecting section **15A** is a length  $L_2$  (FIG. 2), the length  $L_1$  is  $10 \text{ cm}$  to  $30 \text{ cm}$  both inclusive, and the length  $L_2$  is  $1 \text{ mm}$  to  $3 \text{ mm}$  both inclusive, for example. That is, a side of the moisture-proof film **15** is larger than a side of the optical functional film **16** by  $2 \text{ mm}$  to  $6 \text{ mm}$  both inclusive. Although it is preferable to form the projecting section **15A** at all sides (four sides) of the moisture-proof film **15** as illustrated in FIG. 2, the projecting section **15A** may be formed at only one of the sides.

The optical functional film **16** (surface film) is configured to prevent external light from reflecting on a display surface, and is disposed so as to face a display surface of the display layer **13** with the moisture-proof film **15** therebetween, for example. The optical functional film **16** is bonded to the moisture-proof film **15** using an adhesive agent (not illustrated). Specifically the optical functional film **16** has an anti-reflection function or an anti-glare function. The end face of the optical functional film **16** may be located at substantially the same position as the end faces of the TFT layer **12**, the display layer **13**, and the transparent substrate **14** in a vertical direction (FIG. 1), or may be located outwardly of the end faces of the TFT layer **12**, the display layer **13**, and the transparent substrate **14** (on the end face side of the moisture-proof film **15**), as illustrated in FIG. 3. For example, in the case where the optical functional film **16** has an anti-reflection function, the optical functional film **16** may be a laminated body that includes a plurality of thin films having different refractive indexes, and utilizes interference of reflection light occurring at an interface of these thin films in order to attenuate the reflection light. For example, in the case where the optical functional film **16** has an anti-glare function, concavities and convexities may be formed on a surface of the optical functional film **16** with use of a coating material so that external light is diffusely reflected by the concavities and convexities. It is to be noted that, in place of the optical functional film **16**, a film for protection of the display surface from physical stimulation (external force), such as a hard coating film, may be formed as the surface film.

The sealing section **17** is so provided on the substrate **10** (the barrier layer **11**) as to cover the end faces of the TFT layer **12**, the display layer **13**, the transparent substrate **14**, the moisture-proof film **15**, and the optical functional film **16**. In other words, the sealing section **17** is so provided as to surround the periphery of the TFT layer **12**, the display layer **13**, the transparent substrate **14**, the moisture-proof film **15**, and the optical functional film **16**. It is preferable that the sealing section **17** seal end portions of the display device **1** and prevent infiltration of moisture from the side faces. The moisture-proof film **15** is covered with the sealing section **17** at the top face and the bottom face of the projecting section **15A** and at the end face thereof. With this configuration, the moisture-proof property of the display device **1** is further enhanced when the sealing section **17** is of a moisture-proof type. The

5

sealing section 17 is made of, for example, a thermoset acrylic resin, an ultraviolet-curable acrylic resin, a methacrylic resin, an epoxy resin, or the like.

[Method of Manufacturing Display Device 1]

The display device 1 is manufactured in the following manner, for example.

First, for example, with use of silicon as a target, high-frequency sputtering is performed while introducing nitrogen gas to form the barrier layer 11 of silicon nitride on the substrate 10. Next, the above-described TFT layer 12 is formed on a surface of the substrate 10 on which the barrier layer 11 has been formed.

After the TFT layer 12 is formed, a metal film made of, for example, chromium, gold, platinum, nickel, copper, tungsten, or silver is formed on the entire surface of the substrate 10, and the metal film is then patterned to form the pixel electrode 131. Next, an organic layer is formed on the pixel electrode 131 by, for example, an evaporation method to form the display body 132.

Subsequently, the transparent substrate 14 including the common electrode 133, the moisture-proof film 15, and the optical functional film 16 is bonded to the substrate 10 on which the display body 132 and so forth have been formed. For example, the common electrode 133 is formed in advance on one side of the transparent substrate 14 by forming a film of ITO on the entire surface thereof, whereas the moisture-proof film 15 and the optical functional film 16, which may be bonded together using an adhesive agent, are formed in advance on the other side of the transparent substrate 14 by bonding to the transparent substrate 14 using an adhesive agent. In this case, the moisture-proof film 15 and the optical functional film 16 are bonded together such that the end faces of all of the sides of the moisture-proof film 15 are located outwardly of the end faces of the optical functional film 16. Alternatively, the moisture-proof film 15 and the optical functional film 16 may be formed on the transparent substrate 14 after the transparent substrate 14 on which the common electrode 133 has been formed and the substrate 10 are bonded together.

As illustrated in FIG. 4, when the transparent substrate 14 and the substrate 10 are bonded together, an eaves-like structure is formed by the moisture-proof film 15. Specifically, the end face of the moisture-proof film 15 is located outwardly of the side faces of the TFT layer 12, the display layer 13, and the transparent substrate 14, and thus a gap exists between the substrate 10 and the moisture-proof film 15. After the transparent substrate 14 and the substrate 10 are bonded together, a thermoset acrylic resin or an ultraviolet-curable acrylic resin (a pre-curing resin 17a) is applied to the gap with use of, for example, a needle 20 so as to fill the gap. In this case, utilization of the capillary action of the pre-curing resin 17a facilitates the application of the resin to the gap portion. For example, when the viscosity of the pre-curing resin 17a is 10 (Pa·s) or lower, preferably 2 (Pa·s) or lower, it is possible to enhance the production efficiency and the sealing effect by the capillary action. The viscosity of the pre-curing resin 17a may be adjusted by the component of the resin, or may be lowered by heating a syringe main body (not illustrated) or the needle 20. By adjusting the amount of the pre-curing resin 17a, the pre-curing resin 17a is applied to the end faces of the moisture-proof film 15 and the optical functional film 16, and also to the top and bottom faces of the projecting section 15A.

It is preferable to previously perform plasma treatment of oxygen or the like on a portion, of the surface of the moisture-proof film 15, to be brought into contact with the pre-curing resin 17a. This is because such treatment improves the wet-

6

tability of the moisture-proof film 15 and facilitates the application of the pre-curing resin 17a.

After the application of the pre-curing resin 17a, the pre-curing resin 17a is cured by, for example, irradiation of heat or light to thereby form the sealing section 17. Many of films used to configure the optical functional film 16 have an ultraviolet-ray blocking function. In the case where such an optical functional film 16 is used, if the end faces of the moisture-proof film 15 and the optical functional film 16 are in agreement with respect to each other in position (for example, a display device 100 described later (FIG. 6)), ultraviolet light applied thereto is blocked by the optical functional film 16, and consequently the pre-curing resin filled in the gap portion between the substrate 10 and the moisture-proof film 15 may not be cured sufficiently. In contrast, since in the display device 1 the moisture-proof film 15 includes a region not overlapping with the optical functional film 16, namely, the projecting section 15A, it is possible to sufficiently apply ultraviolet light also to the pre-curing resin 17a filled in the gap between the substrate 10 and the moisture-proof film 15.

Further, in the case where the moisture-proof film 15 has an ultraviolet-ray blocking function for example, the sealing section 17 may be formed with use of a resin material that may be cured by light falling outside the wavelength range of the ultraviolet ray to be blocked. FIG. 5 illustrates an exemplary relationship between wavelengths and light transmittances of the moisture-proof film 15 having an ultraviolet-ray blocking function. When the moisture-proof film 15 in this example is used, it suffices to employ a resin material that is cured by application of light of wavelength of 380 nm or longer (visible light). It is to be noted that, in order to secure the flexibility of the display device 1, the Young's modulus of the sealing section 17 (cured resin) is preferably 500 (MPa) or lower, and more preferably 100 (MPa) or lower. In this manner, the display device 1 illustrated in FIG. 1 and FIG. 2 is completed.

[Function and Effect of Display Device 1]

In the display device 1 of the present embodiment, since the moisture-proof film 15 includes the projecting section 15A, the distance along the surfaces defined by the moisture-proof film 15 and the sealing section 17 (outside) is lengthened, and thus the moisture-proof property is enhanced. Hereinafter, improvement in moisture-proof property achieved by the projecting section 15A will be described in detail with reference to a comparative example.

FIG. 6 illustrates, as a comparative example, a side sectional view of a display device 100 in which the moisture-proof film 15 and the optical functional film 16 include end faces located at the same position in a vertical direction. In the display device 100, the end faces of the moisture-proof film 15 and the optical functional film 16 are located outwardly of the end faces of the TFT layer 12, the display layer 13, and the transparent substrate 14 by a length  $L_3$ , whereas the end faces of the moisture-proof film 15 and the optical functional film 16 are in agreement with respect to each other in position. When the moisture-proof film 15 is not provided with the projecting section 15A like in this instance, the boundary surface of the moisture-proof film 15 between the moisture-proof film 15 and the sealing section 17 is composed of the side face thereof and a part of the bottom face thereof, and a distance  $D_{100}$  along the surface is equal to the sum of the film thickness  $T$  of the moisture-proof film 15 and the length  $L_3$ . The display layer 13 is susceptible to degradation by moisture, and therefore, if moisture infiltrates into the display layer 13 from a side face of the display device 100 through the boundary surface between the moisture-proof film 15 and an external part (the sealing section 17), then the reliability of the

7

display device **100** is decreased. If the distance  $D_{100}$  along the surface of the moisture-proof film **15** is lengthened, then the infiltration of moisture into the display layer **13** becomes unlikely, and the moisture-proof property of the display device **100** is enhanced. However, this leads to increase in cost and the planar dimension of a non-display region, and hence it is difficult to increase the length  $L_3$ .

In contrast, in the display device **1** of the present embodiment, the moisture-proof film **15** includes the projecting section **15A**, and accordingly the boundary surface of the moisture-proof film **15** between the moisture-proof film **15** and the sealing section **17** is composed of the end face, top face, and bottom face of the projecting section **15A**. That is, the boundary surface of the moisture-proof film **15** between the moisture-proof film **15** and the sealing section **17** is expanded by an amount corresponding to the planar dimension of the top face of the projecting section **15A**, and a distance  $D_1$  along the surface is lengthened by the length  $L_2$  than the distance  $D_{100}$ . This enhances the moisture-proof property of the display device **1**.

As has been described, since the moisture-proof film **15** includes the projecting section **15A** in the display device **1** of the present embodiment, it is possible to expand the boundary surface between the moisture-proof film **15** and an external part (the sealing section **17**) so as to increase the distance along the surface. This results in an enhanced moisture-proof property of the display device **1**, and improved reliability.

Further, by providing the sealing section **17** in such a manner as to cover the end face, top face, and bottom face of the projecting section **15A** of the moisture-proof film **15**, it is possible to enhance the moisture-proof property.

#### Modification

FIG. **7** shows a cross-sectional configuration of a display device **1A** according to a modification. The display device **1A** includes a set of another optical functional film **16b** and another moisture-proof film **15b** between the moisture-proof film **15** and the optical functional film **16**. Except for this point, the display device **1A** is similar to the display device **1** of the above-mentioned embodiment in configuration, function, and effect.

In the display device **1A**, the moisture-proof film **15**, the optical functional film **16b**, the moisture-proof film **15b**, and the optical functional film **16** are provided in this order from the display layer **13** side, that is, the moisture-proof films and the optical functional films are alternately disposed. The moisture-proof films **15** and **15b** each include the projecting section **15A**. The projecting sections **15A** of the moisture-proof films **15** and **15b** may be formed in regions overlapped in a vertical direction, or may be so formed as to include a region not overlapped with each other in the vertical direction. Since, in addition to the moisture-proof film **15**, the moisture-proof film **15b** includes the projecting section **15A** in the display device **1A**, a distance  $D_1$  along the surfaces defined by the moisture-proof films **15** and **15b** and the sealing section **17** is further lengthened, and consequently the moisture-proof property is further enhanced. Two or more sets of the moisture-proof film **15b** and the optical functional film **16b** may alternatively be adopted. It is preferable that the moisture-proof film **15b** provided between the moisture-proof film **15** and the optical functional film **16** have a moisture-proof property, but a film such as a plastic film having no particular function may also be adopted. It is to be noted that the optical functional film **16b** may be replaced by a protective film.

8

The above-mentioned display devices **1** and **1A** each may be incorporated in electronic apparatuses illustrated in the following application examples 1 to 6, for example.

#### Application Example 1

FIGS. **8A** and **8B** each show an external appearance of an electronic book. This electronic book includes, for example, a display section **210** and a non-display section **220**. The display section **220** is configured of the display device **1** or **1A**.

#### Application Example 2

FIG. **9** shows an external appearance of a television. This television includes, for example, an image display screen section **300** provided with a front panel **310** and a filter glass **320**. The image display screen section **300** is configured of the display device **1** or **1A**.

#### Application Example 3

FIGS. **10A** and **10B** each show an external appearance of a digital still camera. This digital still camera includes, for example, a light emitting section **410** configured to generate flash light, a display section **420**, a menu switch **430**, and a shutter button **440**. The display section **420** is configured of the display device **1** or **1A**.

#### Application Example 4

FIG. **11** shows an external appearance of a notebook personal computer. This notebook personal computer includes, for example, a main body **510**, a keyboard **520** used to input letters and the like, and a display section **530** configured to display an image. The display section **530** is configured of the display device **1** or **1A**.

#### Application Example 5

FIG. **12** shows an external appearance of a video camcorder. This video camcorder includes, for example, a main body section **610**, a lens **620** provided on a front side face of the main body section **610** and configured to take an image of a subject, a start and stop switch **630** used to capture an image, and a display section **640**. The display section **640** is configured of the display device **1** or **1A**.

#### Application Example 6

FIGS. **13A** to **13G** each show an external appearance of a mobile phone. This mobile phone includes, for example, an upper side housing **710**, a lower side housing **720**, a coupling section (hinge section) **730** coupling the upper side housing **710** and the lower side housing **720**, a display **740**, a sub-display **750**, a picture light **760**, and a camera **770**. One or both of the display **740** and the sub-display **750** are configured of the display device **1** or **1A**.

Hereinabove, while the present technology has been described with reference to the example embodiment and the modification, the present technology is not limited to the above-mentioned embodiment and so forth, and various modifications may be made. For example, while the display body **132** is configured of an organic layer in the above-mentioned embodiment and so forth, the display body **132** may alternatively be an inorganic layer including a light emitting layer, a liquid crystal layer, or an electrophoretic display



body. In other words, each of the display devices **1** and **1A** may be an inorganic EL display device, a liquid crystal display device, or an electrophoretic display device.

Further, the material and the thickness of the layers, the film formation method, the film formation condition, and the like described in the above-mentioned embodiment and so forth are not limitative. Other materials, thicknesses, film formation methods, and film formation conditions may alternatively be adopted.

In addition thereto, while the configurations of the display devices **1** and **1A** have been specifically described in the above-mentioned embodiment and so forth, all of the layers do not necessarily have to be included, and other layers may further be included.

Accordingly, it is possible to achieve at least the following configurations from the above-described example embodiment, the modifications, and the application examples of the disclosure.

(1) A display device, including:

a display layer;  
a surface film disposed to face a display surface of the display layer; and

a moisture-proof film disposed between the display layer and the surface film and including a projecting section, the projecting section projecting outwardly of an end face of the display layer and an end face of the surface film.

(2) The display device according to (1), further including a sealing section covering the end face of the display layer, an end face of the moisture-proof film, and the end face of the surface film, and covering upper, lower, and end faces of the projecting section.

(3) The display device according to (1) or (2), wherein the surface film has any one of an anti-reflection function, an anti-glare function, and a protective function against external force.

(4) The display device according to any one of (1) to (3), wherein the moisture-proof film has a moisture permeability of 0.03 g/m<sup>2</sup>/day or lower.

(5) The display device according to any one of (1) to (4), wherein the display layer includes any one of: an organic layer that includes a light emitting layer; an inorganic layer that includes a light emitting layer; a liquid crystal layer; and an electrophoretic display body.

(6) The display device according to any one of (1) to (5), wherein the end face of the surface film agrees in position with the end face of the display layer vertically, or is located outwardly of the end face of the display layer.

(7) The display device according to any one of (1) to (6), wherein another at least one set of the surface film and the moisture-proof film is disposed alternately between the moisture-proof film and the surface film.

(8) An electronic apparatus with a display device, the display device including:

a display layer;  
a surface film disposed to face a display surface of the display layer; and

a moisture-proof film disposed between the display layer and the surface film and including a projecting section, the projecting section projecting outwardly of an end face of the display layer and an end face of the surface film.

It is to be noted that any combinations of (2) to (7) directed to the display device are applicable to (8) directed to the electronic apparatus unless any contradictions occur. Such combinations are also considered as preferred ones of embodiments according to the technology.

The present disclosure contains subject matter related to that disclosed in Japanese Priority Patent Application JP

2012-024770 filed in the Japan Patent Office on Feb. 8, 2012, the entire content of which is hereby incorporated by reference.

It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

What is claimed is:

1. A display device, comprising:

a display layer;  
a film disposed to face a display surface of the display layer;

first moisture-proof film disposed between the display layer and the film, the first moisture-proof film including a projecting section projecting outwardly of an end face of the display layer and an end face of the film, wherein the film is bonded to the moisture-proof film;

a second moisture-proof film disposed between the film and a surface film, the second moisture-proof film including a projecting section that projects outwardly of an end face of the film and the surface film; and

a sealing section including a cured resin having a pre-cured viscosity that is less than or equal to 10 Pa·s, wherein the resin covers the end face of the display layer, an end face of the first moisture-proof film, an end face of the second moisture-proof film, the end face of the surface film, the end face of the film, and portions of upper and lower faces of the first and second moisture-proof film projecting sections.

2. The display device according to claim 1, wherein the surface film includes at least one of an anti-reflection function, an anti-glare function, and a protective function protecting against one or more external forces.

3. The display device according to claim 1, wherein the first moisture-proof film has a moisture permeability of 0.03 g/m<sup>2</sup>/day or lower.

4. The display device according to claim 1, wherein the display layer includes at least one of: an organic layer that includes a light emitting layer; an inorganic layer that includes a light emitting layer; a liquid crystal layer; and an electrophoretic display body.

5. The display device according to claim 1, wherein the end face of the surface film agrees in position with the end face of the display layer vertically, or is located outwardly of the end face of the display layer.

6. The display device according to claim 1, wherein the surface film includes at least one of an anti-reflection function and an anti-glare function.

7. The display device according to claim 1, further comprising:

a semiconductor layer disposed between the display layer and a barrier layer; and

a substrate, wherein the barrier layer is disposed on the substrate, wherein the resin is disposed between a top portion of the barrier layer and the first moisture-proof film.

8. The display device according to claim 7, wherein the resin covers an end face of the semiconductor layer.

9. An electronic apparatus with a display device, the display device comprising:

a display layer;  
a film disposed to face a display surface of the display layer;

first moisture-proof film disposed between the display layer and the film, the first moisture-proof film including a projecting section projecting outwardly of an end face

## 11

of the display layer and an end face of the film, wherein the film is bonded to the first moisture-proof film;  
 a second moisture-proof film disposed between the film and a surface film, the second moisture-proof film including a projecting section that projects outwardly of an end face of the film and the surface film; and

a sealing section including a cured resin having a pre-cured viscosity that is less than or equal to 10 Pa·s, wherein the resin covers the end face of the display layer, an end face of the first moisture-proof film, an end face of the second moisture-proof film, the end face of the surface film, the end face of the film, and portions of upper and lower faces of the first and second moisture-proof film projecting sections.

10. The electronic apparatus according to claim 9, wherein the surface film includes at least one of an anti-reflection function, an anti-glare function, and a protective function protecting against one or more external forces.

11. The electronic apparatus according to claim 9, wherein the first moisture-proof film has a moisture permeability of 0.03 g/m<sup>2</sup>/day or lower.

12. The electronic apparatus according to claim 9, wherein the display layer includes at least one of: an organic layer that

## 12

includes a light emitting layer; an inorganic layer that includes a light emitting layer; a liquid crystal layer; and an electrophoretic display body.

13. The electronic apparatus according to claim 9, wherein the end face of the surface film agrees in position with the end face of the display layer vertically, or is located outwardly of the end face of the display layer.

14. The electronic apparatus according to claim 9, wherein the film includes at least one of an anti-reflection function and an anti-glare function.

15. The electronic apparatus according to claim 9, further comprising:

a semiconductor layer disposed between the display layer and a barrier layer; and

a substrate, wherein the barrier layer is disposed on the substrate,

wherein the resin is disposed between a top portion of the barrier layer and the first moisture-proof film.

16. The electronic apparatus according to claim 15, wherein the resin covers an end face of the semiconductor layer.

\* \* \* \* \*